CLAIMS:

1. A sulfate process for producing titania from a titaniferous material which includes the steps of:

(a) leaching the solid titaniferous material with a leach solution containing sulfuric acid and forming a leach liquor that includes an acidic solution of titanyl sulfate ($TiOSO_4$) and iron sulfate ($FeSO_4$);

(b) separating the leach liquor and a residual solid phase from the leach step (a);

(c) separating titanyl sulfate from the leach liquor from step (b);

(d) hydrolysing the separated titanyl sulfate and forming a solid phase containing hydrated titanium oxides;

(e) separating the solid phase containing hydrated titanium oxides and a liquid phase that are produced in the hydrolysis step (d); and

(f) calcining the solid phase from step (e) and forming titania;

and is characterised by the steps of:

(i) a further leach step of leaching the residual solid phase from step (b) with a leach solution containing sulfuric acid and forming a leach liquor that includes an acidic solution of titanyl sulfate and iron sulfate and a residual solid phase;

(ii) separating the leach liquor and the residual solid phase from step (i); and

(iii) supplying the separated leach liquor to the leach step (a) and/or mixing the separated leach liquor with the leach liquor from step (b).

2. The process defined in claim 1 includes carrying out the leach step (a) and the further leach step (i) in the same vessel.

3. The process defined in claim 2 includes returning the residual solid phase from step (b) to the vessel, wherein the residual solid phase forms part of the titaniferous material subjected to leaching in the leach step (a).

4. The process defined in claim 1 includes carrying out the leach step (a) and the further leach step (i) in a separate vessel or vessels.

5. The process defined in claim 4 wherein the further leach step (i) includes supplying the residual solid phase from step (b) to the vessel or vessels.

6. The process defined in any one of the preceding claims wherein the leach step (a) and/or the further leach step includes selecting and/or controlling the leach conditions in the leach step or steps to avoid undesirable amounts of premature hydrolysis of hydrated titanium oxides and undesirable amounts of premature precipitation of titanyl sulfate.

7. The process defined in claim 6 wherein the leach conditions include any one or more than one of acid concentration, leach temperature and leach time.

8. The process defined in claim 6 or claim 7 includes selecting and/or controlling the acid concentration to be at least 350 g/l sulfuric acid throughout the leach step (a) and/or the further leach step (i) when operating at a leach temperature in the range of 95°C to the boiling point in order to avoid premature hydrolysis.

9. The process defined in any one of claims 6 to 8 includes selecting and/or controlling the acid concentration at the end of the leach step (a) and/or the further leach step (i) to be less than 450 g/l when operating at a leach temperature in the range of 95°C to the boiling point in order to avoid an undesirable amount of premature precipitation of titanyl sulfate.

10. The process defined in any one of claims 6 to 9 includes selecting and/or controlling the leach conditions so that the titanium ion concentration in the leach liquor is less than 50 g/l in the leach liquor at the end of the leach step (a) and/or the further leach step (i).

11. The process defined in claim 10 includes selecting and/or controlling the leach conditions so that the titanium ion concentration in the leach liquor is 40-50 g/l in the leach liquor at the end of the leach step (a) and/or the further leach step (i).

12. The process defined in any one of the preceding claims includes carrying out the leach step (a) and/or the further leach step (i) in the presence of an additive that accelerates the rate of leaching the titaniferous material.

13. The process define in claim 12 wherein the leaching accelerant is selected from a group that includes

iron, a titanium (III) salt, a thiosulfate salt, sulfur dioxide or any other reduced sulfur containing species.

14. The process defined in any one of the preceding claims includes carrying out the leach step (a) and/or the further leach step (i) in the presence of a reductant that reduces ferric ions to ferrous ions in the acidic solution or solutions of titanyl sulfate and iron sulfate produced in the leach step (a).

15. The process defined in claim 14 wherein the reductant is selected from a group that includes iron, a titanium (III) salt, a thiosulfate salt, sulfur dioxide or any other reduced sulfur containing species.

16. The process defined in any one of the preceding claims wherein the leach step (a) solubilises at least 50% by weight of the titaniferous material supplied to the leach step.

17. The process defined in any one of the preceding claims includes the steps of precipitating iron sulfate from the leach liquor from step (b) and separating precipitated iron sulfate from the leach liquor prior to the titanyl sulfate separation step (c).

18. The process defined in any one of the preceding claims includes using at least part of the leach liquor remaining after separation of titanyl sulfate in step (c) as at least part of the leach solution in the leach step (a) and/or in the further leach step (i).

19. The process defined in claim 18 wherein the titanyl sulfate separation step (c) includes a solvent extraction step of extracting titanyl sulfate from the leach liquor from step (b) into a solvent and thereafter stripping titanyl sulfate from the solvent and forming a

solution that contains titanyl sulfate and thereafter hydrolysing the titanyl sulfate-containing solution in the hydrolysis step (d).

20. The process defined in claim 19 includes using at least part of a raffinate from the solvent extraction step as at least part of the leach solution in leach step (a) and/or in the further leach step (i).

21. The process defined in claim 20 wherein the leach solution in the leach step (a) and the further leach step (i) includes the raffinate and make-up fresh sulfuric acid.

22. The process defined in claim 20 or claim 21 wherein the raffinate from the solvent extraction step has an acid concentration of at least 250 g/l sulfuric acid.

23. The process defined in any one of claims 19 to 22 wherein the solvent extraction step includes contacting the leach liquor with the solvent which includes a modifier.

24. The process defined in any one of the preceding claims includes controlling the hydrolysis step (d) to produce a selected particle size distribution of the hydrated titanium oxides product.